REMARKS

Favorable reconsideration and allowance of the claims of the present application are respectfully requested.

Claims 1, 2, 15 and 16 stand rejected under 35 U.S.C. 103(a) as allegedly obvious over U.S. Patent No. 6,331,487 to Koch ("Koch") in view of U.S. Patent No. 6,355,153 to Uzoh, et al. ("Uzoh, et al.") and further in view of U.S. Patent No. 5,897,349 to Agnello ("Agnello"). Claims 3-14 stand rejected under 35 U.S.C. 103(a) as allegedly obvious over the combination of Koch, Uzoh, et al., Agnello and the article to R. Alm entitled "Formulation Techniques using Triflic Acid Salts" ("Alm"). Claims 17 – 20 stand rejected under 35 U.S.C. §103(a) as allegedly obvious over Koch in view of Agnello and further in view of U.S. Patent No. 6,316,057 to Hirayama, et al. ("Hirayama, et al.").

Applicants submit that the claims of the present invention are not rendered obvious by the disclosure of Koch in combination with Uzoh, et al., or further in combination with Agnello, Alm or Hirayama, et al. since none of the applied references teaches or suggests applicants' claimed process of cleaning a precision surface comprising contacting a reactive ion etched precision surface having vias, cavities, trenches or channels incorporated therein, said reactive ion etched precision surface containing reactive ion etch residue, with *a composition which comprises liquid or supercritical carbon dioxide and a fluoride-generating species until the reactive ion etch residue is removed from the precision surface.* "To establish a prima facie case of obviousness of a claimed invention all the claimed limitations must be taught or suggested by the prior art". *In re Wilson,* 424 F.2d 1382, 1385, 165 USPQ 44, 496 (CCPA 1970). More specifically, none of the applied references provide a cleaning

composition that will remove reactive ion etch residue from the precision surface, where the integrity of the vias, cavities, trenches or channels of the precision surface are maintained.

Applicants respectfully submit that the claims of the present application are not obvious from the disclosure of Koch since the applied reference does not teach or suggest applicants' claimed process which removes *reactive ion etch residue from a reactive ion etched precision surface that contains vias, cavities, trenches or channels incorporated therein.* Instead, Koch provides a process for removing chemical mechanical polishing (CMP) residue from a previously polished surface layer. The CMP residue disclosed in Koch contains CMP chemicals (such as a silica-based or metallic based slurry material) and particles (from the polished surface) that are formed following the CMP process.

In the claimed process, reactive ion etch residue is removed from a reactive ion etched precision surface. The reactive ion etch residue that is removed by the inventive process is composed of etchant gas material, the material being etched as well as the polymeric photoresist material, which is used in forming the vias, cavities, trenches or channels. Applicants, referring to Page 6, lines 5-8, further define the reactive ion etch residue formed on the "RIE precision surfaces, [to be] a polymeric type deposit which resembles polyflouroethylene." Specifically, applicants disclose that the reactive ion etch residue contains one or more of the following elements: carbon, hydrogen, silicon, aluminum, titanium, tungsten, platinum, palladium, iridium, chromium, fluorine, chlorine, and oxygen. Applicants respectfully submit that the reactive ion etched residue removed by the claimed process is different from the CMP residue that is removed in the process disclosed in Koch.

Applicants further submit that in the present claimed process the reactive ion etch residue is removed from a reactive ion etched precision surface that contains vias, cavities,

trenches and channels therein. In contrast thereto, the CMP residue is removed from a surface, which has been planarized by a CMP process. As is well known to those skilled in the art, the CMP process is not used in forming precision surfaces that have vias, cavities, trenches, and channels. Instead, the CMP process provides a planarized surface.

Uzoh, et al. do not alleviate the above deficiencies in Koch since the applied secondary reference also does not teach or suggest a process for removing *reactive ion etch residue from a reactive ion etched precision surface that contains vias, cavities, trenches or channels incorporated therein.* Instead, Uzoh, et al. disclose selectively removing portions of a seed layer **6** from a top surface of a substrate **2** and then depositing a conductive material **8** in the cavities of the substrate, where portions of the seed layer **8** remain in the cavities. Uzoh, et al. further disclose, referring to column 5, lines 50-53, where, "a porous pad type material **20** with or without fixed abrasive particles is used to selectively polish the seed layer **6** from the top surface of the substrate." Therefore, Uzoh, et al. disclose an abrasive contact used to planarized or polish a surface, similar to Koch, and is far removed from applicants' process for removing *reactive ion etch residue from a reactive ion etched precision surface that contains vias, cavities, trenches or channels incorporated therein.*

Applicants note that although Uzoh, et al. make reference to reactive ion etching, Uzoh, et al. do not teach or suggest cleaning a reactive ion etched precision surface that contains vias, cavities, trenches, or channels incorporated therein, as recited in Claim 1. Uzoh, et al., referring to column 7, lines 19-24, disclose where, "after depositing the conductive material in the cavities the barrier layer can be removed, by conventional polishing or reactive ion etch (RIE), after selectively removing the barrier layer and planarizing/polishing the top surface of the substrate." Referring to column 8, lines 9-13,

Uzoh, et al. further disclose where, "after depositing the second conductive material 26 on the first conductive material 24, the second conductive material 26 can be planarized using CMP or RIE to form the structure as illustrated in FIG. 3Biid." Applicants note that the RIE process steps disclosed in Uzoh, et al. are conducted after material has been deposited into the cavities of the substrate in a permanent manner. Since material remains within the cavities of the substrate any later processing steps, whether they include CMP or RIE, cannot remove residue that is already within the cavities of the device. The above noted RIE process steps are employed in a planarizing manner, similar to CMP, and are not utilized in a manner, which allows for reactive ion residue to be removed from the cavities and vias of the precision surface of the substrate. Therefore, Uzoh, et al. do not teach or suggest applicants' process for removing *reactive ion etch residue from a reactive ion etched precision surface that contains vias, cavities, trenches or channels incorporated therein*, as recited in Claim 1.

In addition, Uzoh, et al. teach away from the current invention, which removes reactive ion etch residue from the vias, trenches, and cavities of the reactive ion etched precision surface. A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. W.L. Gore and Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983). Uzoh, et al., referring to column 6, lines 14-19, disclose that, "the purpose of applying the electrical potential between the anode **22** and the conducting substrate and generating an electric current is to avoid the dissolution of the seed layer **6** in the cavities during the process of polishing the top surface of the surface of the substrate." Therefore, since Uzoh et al. disclose a means for protecting material within the vias, cavities, or trenches of a substrate surface, Uzoh et al.

teach away from applicants' method of cleaning a reactive ion etched precision surface having vias, cavities, trenches, or channels incorporated therein, as recited in Claim 1.

Applicants further note that Uzoh, et al. fail to teach or suggest a composition, which comprises liquid or supercritical carbon dioxide and a fluoride-generating species for removing reactive ion etch residue from a precision surface.

Agnello does not alleviate the deficiencies in Koch or Uzoh, et al. since Agnello does not teach or suggest a process for cleaning a precision surface by contacting reactive ion etched precision surface having vias, cavities, trenches or channels incorporated therein, said reactive ion etched precision surface containing reactive ion etch residue, with a composition which comprises liquid or supercritical carbon dioxide and a fluoride-generating species *until the reactive ion etch residue is removed from the precision surface*. Agnello discloses a method for providing a self-aligned capped conductor suitable for borderless contacts, which may be placed on the gate after all front end processing is completed. More specifically, Agnello disclose forming the gate conductor subsequent to the device doping and heat cycles for formulation of the source and drain junction and is far removed from applicants' process for cleaning precision surfaces.

It appears to be the Examiner's position, as stated on Page 3 of the present Office Action, that Agnello discloses a method of removing reactive ion etch residue from a precision surface with another reactive ion etch. Applicants submit that by utilizing reactive ion etch to remove etch residue from a precision surface removes the precision surface itself. Referring to the passage cited by the Examiner (see Col. 5, lines 55-66), Agnello discloses a method of subtractively etching a layer of Si_3N_4 to form sidewall spacers 18 using a mixture of CF_3 and O_2. Etch chemistries which subtractively etch material destroy precision surfaces by removing the features of the precision surfaces including: vias, cavities, trenches or

channels. Therefore, since Agnello discloses etch chemistries which remove the features of the precision surface, Agnello fails to teach or suggest cleaning a precision surface *with a composition which comprises liquid or supercritical carbon dioxide and a fluoride-generating species until the reactive ion etch residue is removed from the precision surface,* as recited in Claim 1.

Applicants note, referring to Col. 5, lines 27-32, a single reference to chemical cleaning to remove reactive ion etch residue, where the chemical cleaning composition include dilute HF etching and etching in sulphuric/peroxide or another acidic or basic peroxide mixtures. Applicants submit that the above cleaning compositions, being aqueous solutions, can not overcome the surface tension of precision surfaces and therefore can not remove reactive ion etch residues from precisions surfaces. Applicants have disclosed that the surface tension of the precision surfaces is overcome using liquid or supercritical carbon dioxide. Therefore, since Agnello fails to teach or suggest liquid or supercritical carbon dioxide or similar cleaning compositions, Agnello fail to teach or suggest *removing reactive ion etch residue from a precision surface.*

Alm also does not alleviate the above deficiencies in Koch or Uzoh, et al. since Alm also does not teach or suggest a process for cleaning a precision surface by removing *reactive ion etch residue from a reactive ion etched precision surface that contains vias, cavities, trenches or channels incorporated therein.* Instead, Alm discloses the use of acid catalysts based on trifluoromethanesulfonic (triflic) acid that, when heated, catalyze the polymerization of cationically sensitive thermoset resin coatings. Applicants respectfully submit that the disclosure of Alm does not teach or suggest that triflic acid or one of its salts can be used in conjunction with liquid or supercritical fluid carbon dioxide to remove *reactive ion etch*

residue from a reactive ion etched precision surface that contains vias, cavities, trenches or channels incorporated therein.

Hirayama, et al. do not alleviate the deficiencies in Koch, Uzoh, et al., Agnello or Alm since the applied secondary reference also does not teach or suggest a process for removing *reactive ion etch residue from a precision surface that contains vias, cavities, trenches or channels incorporated therein.* Instead, Hirayama, et al. disclose a process for coating a surface of a semiconductor device which comprises the steps of applying a reagent comprising a reactive group selected from Si-H, Sn-H and Ge-H, in the presence of a platinum metal onto a surface that is to be coated. Applicants respectfully submit that the disclosure of Hirayama, et al. does not teach or suggest that the reagent disclosed therein can be used in conjunction with liquid or supercritical fluid carbon dioxide to remove *reactive ion etch residue from a reactive ion etched precision surface that contains vias, cavities, trenches or channels incorporated therein.*

The various §103 rejections also fail because there is no motivation in the applied references, which suggest modifying the disclosed processes such that the same can be used for removing *reactive ion etch residue from a reactive ion etched precision surface that contains vias, cavities, trenches or channels incorporated therein.* Thus, there is no motivation provided in the applied references, or otherwise of record, to make the modification mentioned above. "The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." In re Vaeck, 947 F.2d, 488, 493, 20 USPQ 2d. 1438, 1442 (Fed.Cir. 1991).

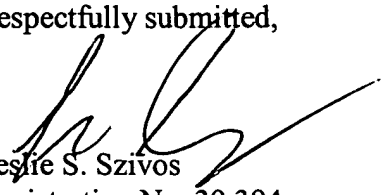
Additionally, there is no motivation to combine Koch, Uzoh, et al., Agnello, Alm and Hirayama, et al. because combining the prior art references would render the primary reference unsatisfactory for its intended purpose. If a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no motivation to make the proposed modification. *In re Gordan*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). The claimed combination cannot change the principle of operation of the primary reference or render the reference inoperable for its intended purpose. *See* MPEP 2145. Applicants submit that combination of Agnello with the primary reference, Koch, renders the primary reference inoperable for its intended purpose.

Referring to column 1, lines 45-48, and column 4, lines 21-25, the purpose of the method disclosed in Koch is to remove CMP residue without introducing defects or scratches to the polished substrate surface. It is the Examiner's position that it would have been obvious to one of ordinary skill in the art to modify Koch by removing reactive ion etch residue using an additional reaction ion etch, as taught by Agnello. The passage of Agnello cited by the Examiner discloses forming sidewall spacers by a subtractive etch using a mixture of CF_3 and O_2. *See* Col. 5, lines 55-66. Incorporating the subtractive etch process disclosed in Agnello into the Koch CMP cleaning method removes material from the CMP polished surface effectively destroying the polished character of the substrate and producing defects. Therefore, since the combination of Angello and Koch render Koch unsatisfactory for its intended purpose of producing a clean defect free polished substrate there is no motivation to combine these references.

The rejections under 35 U.S.C. §103 have been obviated; therefore reconsideration and withdrawal thereof is respectfully requested.

Thus, in view of the foregoing amendments and remarks, it is firmly believed that the present case is in condition for allowance, which action is earnestly solicited.

Respectfully submitted,



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